PLC User's Manual

Setup and configuration

Note: You can hit the "Previous" button to return to the previous screen to modify its settings.

1. When powered on, the PLC will start at the screen in Figure 1. Touch the Motor ID table and select the appropriate motor from the list. Press "Next" to move to the Pump ID screen (Figure 2).
2. Touch the Pump ID table and select the appropriate motor from the list. Press "Next" to move to the Serial number and employee number screen (Figure 3).

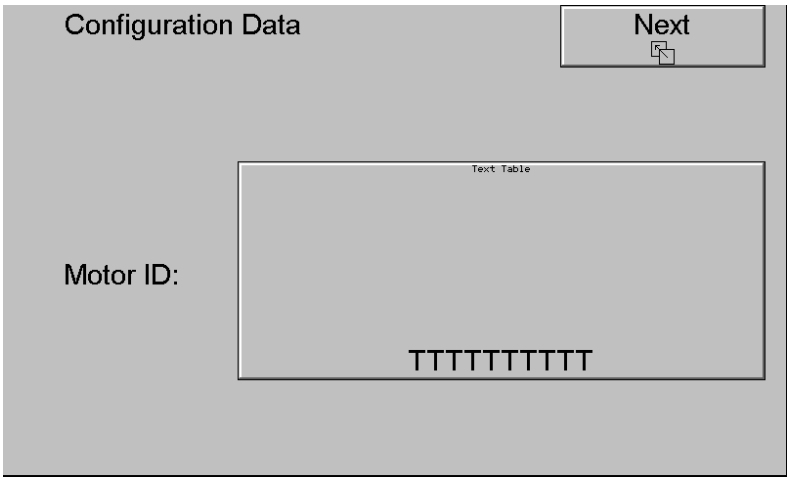


Figure 1: First setup screen - Motor ID

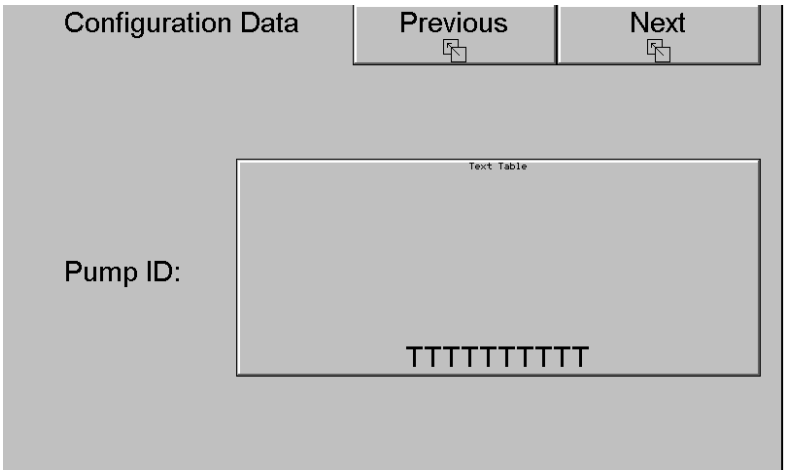


Figure 2: Pump ID screen

3. Touch the "Serial Number" box and enter the pump/motor serial number. Fill in your employee number by pressing the "Employee Number" box. Press "Next" to move to the pressure settings screen (Figure 4).
4. If you would like to measure pressure, verify that these sensors are enabled (if they are disabled, simply press the button next to the sensor name). Then enter the minimum and maximum pressures for suction and discharge (in units of PSI). Finally, enter the minimum and maximum differential pressure values (also in units of PSI). When finished (or if you do not wish to measure pressure), press "Next" to move to the flow rate settings screen (Figure 5).

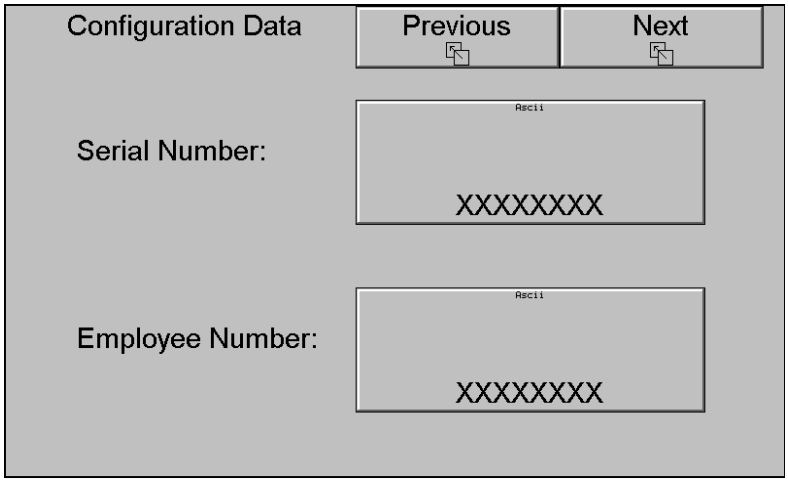


Figure 4: Serial number and employee number screen

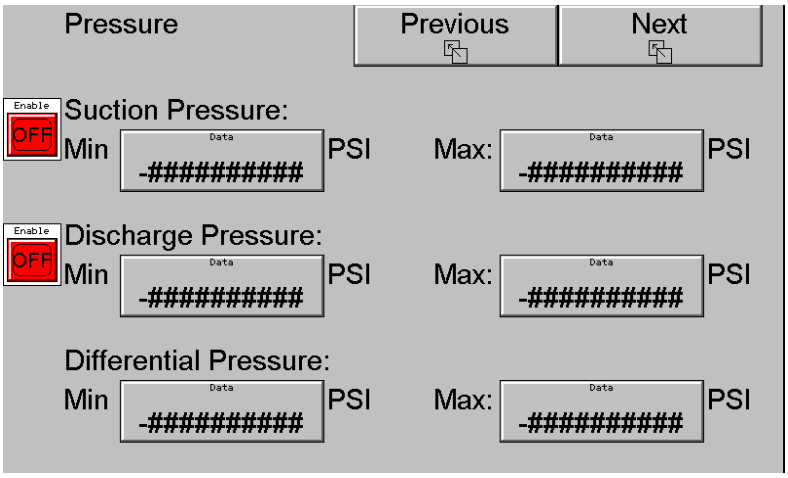


Figure 3: Pressure settings screen

5. If you would like to measure flow rates, verify that these sensors are enabled (if they are disabled, simply press the button next to the sensor name). Then enter the minimum and maximum flow rates for suction and discharge (in units of GPM). Finally, enter the minimum and maximum slip values (also in units of GPM). When finished (or if you do not wish to measure flow rates), press "Next" to move to the first temperature settings screen (Figure 6).
6. Verify that the appropriate temperature sensors are enabled (if they are disabled, simply press the button next to the sensor name). Then enter the minimum and maximum temperatures for each sensor (in units of degrees Fahrenheit). Repeat for all twelve sensors by pressing "Next" to move to the next temperature settings screen (Figures 7, 8, and 9). When finished temperature setup, press "Next" to proceed to the motor characteristics (electrical) screen (Figure 10).

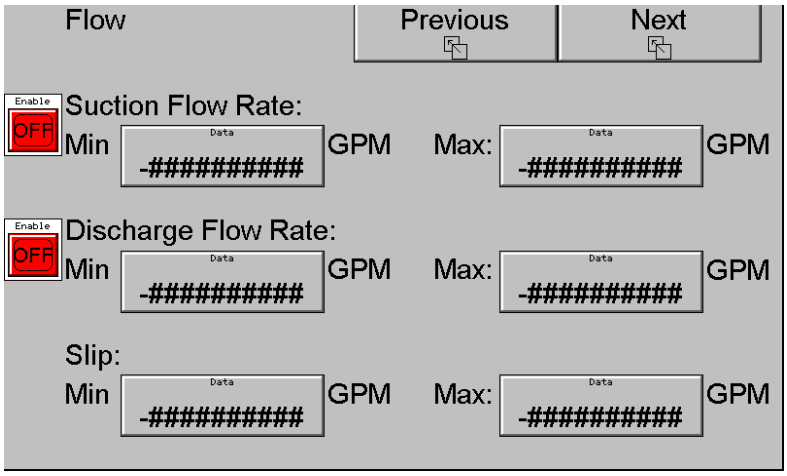


Figure 5: Flow rate settings screen

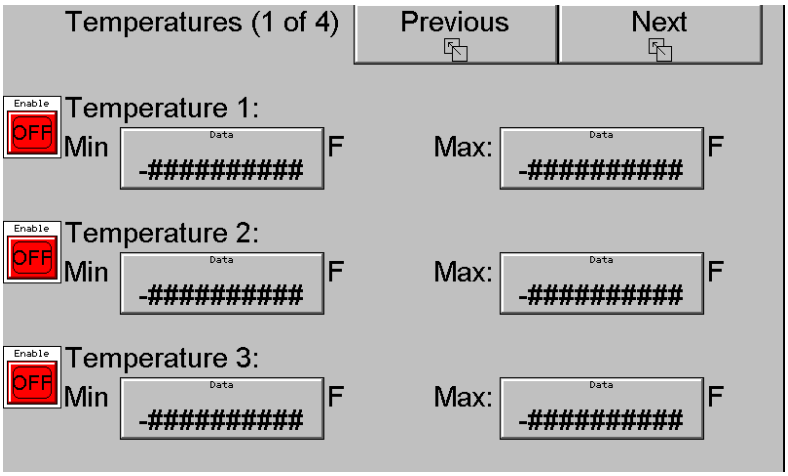


Figure 6: Temperature settings (1/4)

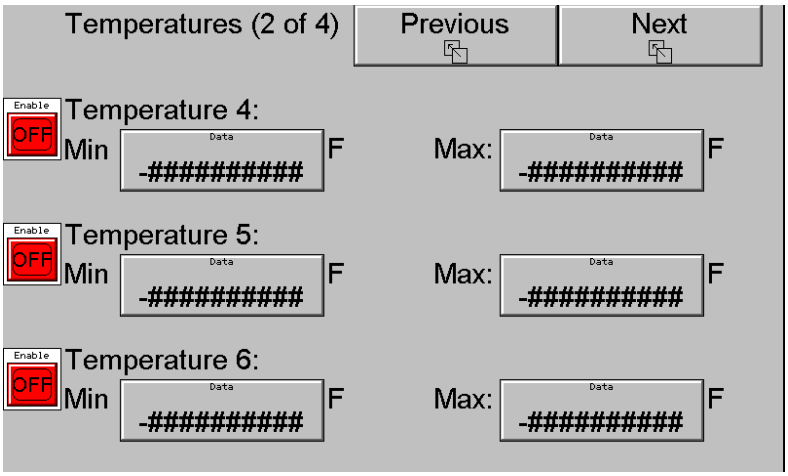


Figure 7: Temperature settings (2/4)

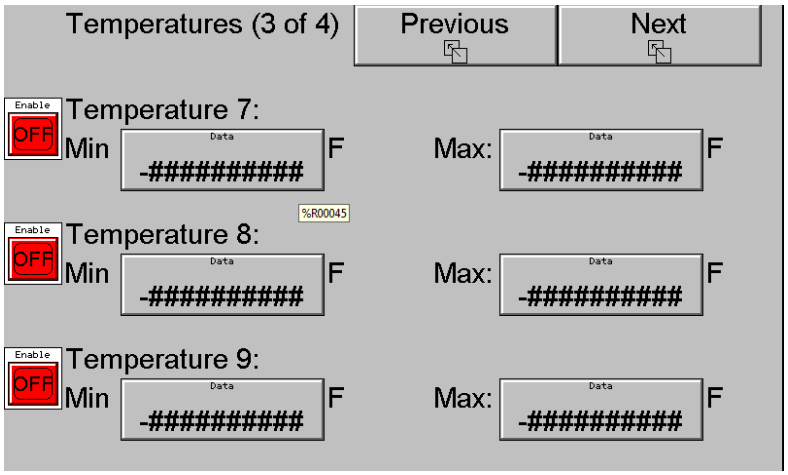


Figure 8: Temperature settings (3/4)

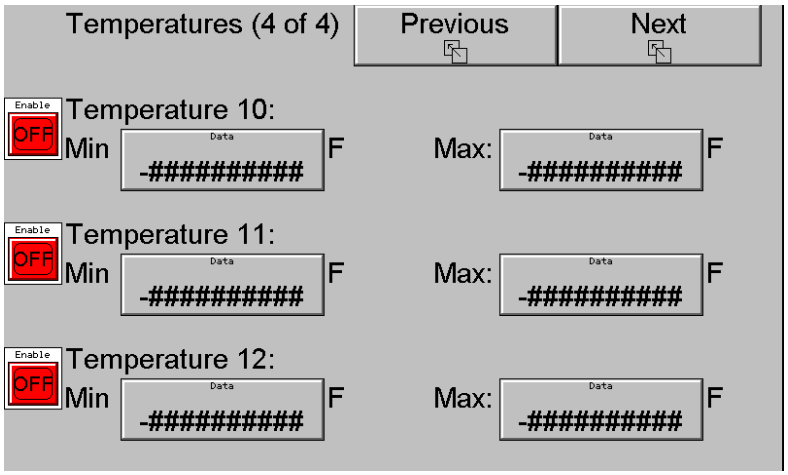


Figure 9: Temperature settings (4/4)

7. If you would like to measure electrical motor characteristics, verify that the appropriate sensors are enabled (if they are disabled, simply press the button next to the sensor name). Then enter the minimum and maximum values for the indicated quantity. When finished (or if you do not wish to measure any of these quantities), press "Next" to move to the motor characteristics (mechanical) screen (Figure 11).
8. If you would like to measure mechanical motor characteristics, verify that the appropriate sensors are enabled (if they are disabled, simply press the button next to the sensor name). Then enter the minimum and maximum values for the indicated quantity. Also verify that the "Removable Media" box is green (indicating that the SD card has been detected by the system). When finished (or if you do not wish to measure any of these quantities), press "Next" to move to the start screen (Figure 12). You have now completed startup.

Note: Torque is measured as a percentage of the maximum load of the pump.

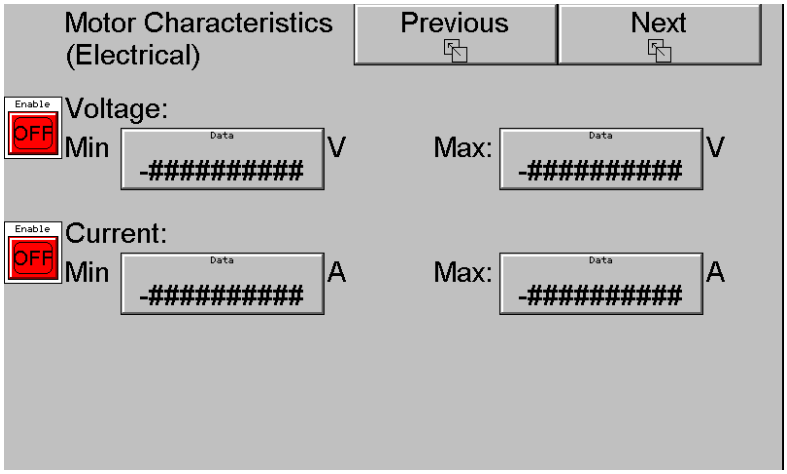


Figure 10: Motor characteristics (electrical) screen

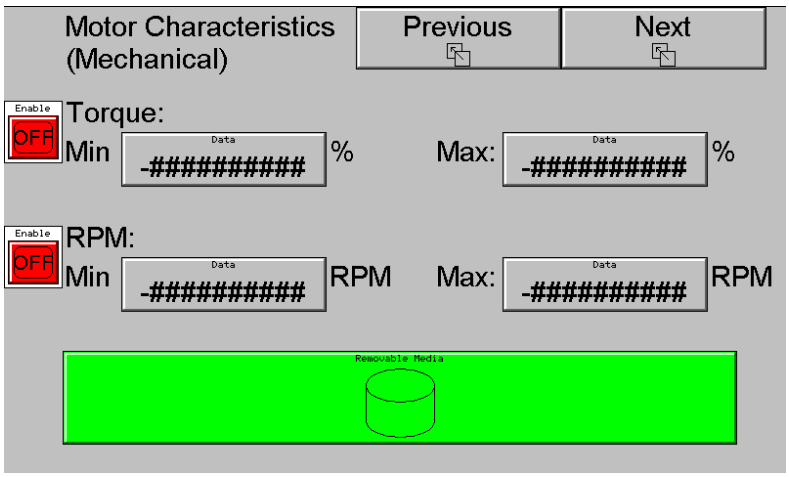


Figure 11: Motor characteristics (mechanical) screen

Running the system

1. Complete setup. If setup has not been run yet, press the Setup button and follow the setup directions (page 1) before proceeding.
2. Select the desired sampling rate. Note that there is a limited number of choices available. If you would like a different sampling rate, please contact the PLC code maintainer. Press "Start" to proceed to the calibration screen.
3. Calibrate the system and ensure all valves, etc. are in the appropriate position. When finished calibrating, press the "Calibration Incomplete" button to change it to "Calibration Complete". The timers will count to 5:00 and 15:00 due to sensor and VFD constraints. When the timers complete, the system will move on to the stop screen automatically (Figure 14).

Note to maintainer: The "Skip Setup (Debug)" button may be pressed to bypass the timers to ease debugging. The calibration button must still be set.

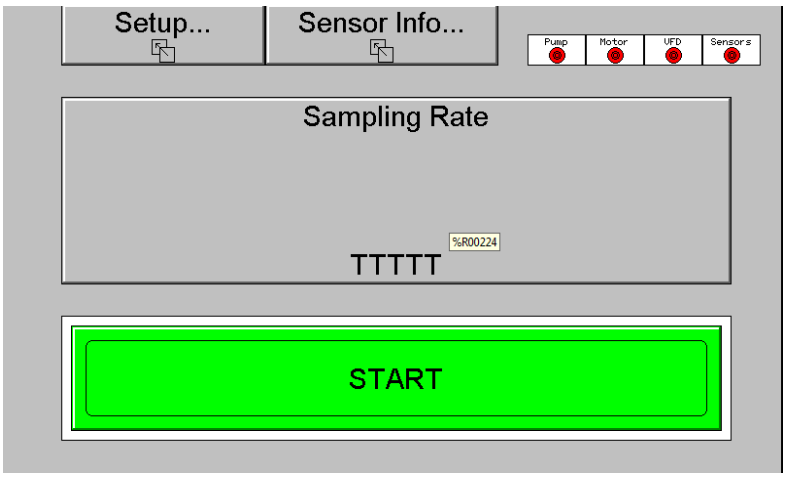


Figure 12:Start screen

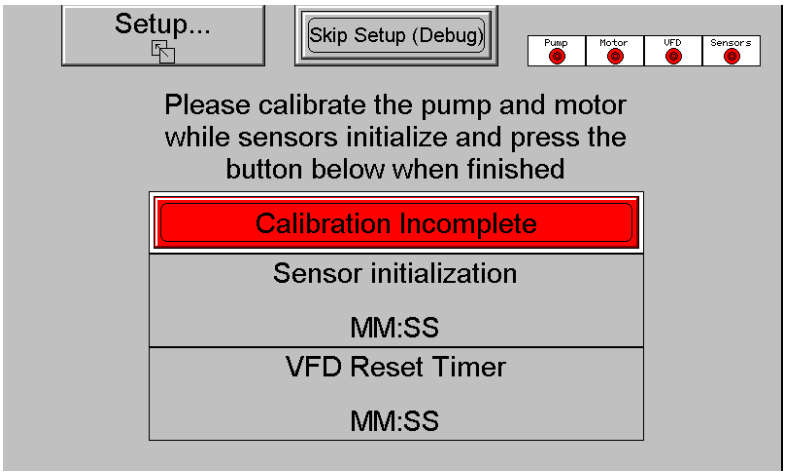


Figure 13: Calibration screen

4. The pump and motor should now be starting, and data collection has begun. If you would like to stop the system at any time, simply press the "STOP" button or the physical Emergency stop button included with the system. If any fault conditions are detected, the system will send a stop signal to the VFD to turn off the pump and motor.
5. When a run is ended, the fault code display screen (Figure 16) will be shown. This screen indicates the fault code for the shutdown condition (refer to the appendix on page 10 for a table of fault codes). You may return to the start screen (Figure 12) by pressing "Run again…" or return to the initial setup (Figure 1) by pressing "Return to setup…"

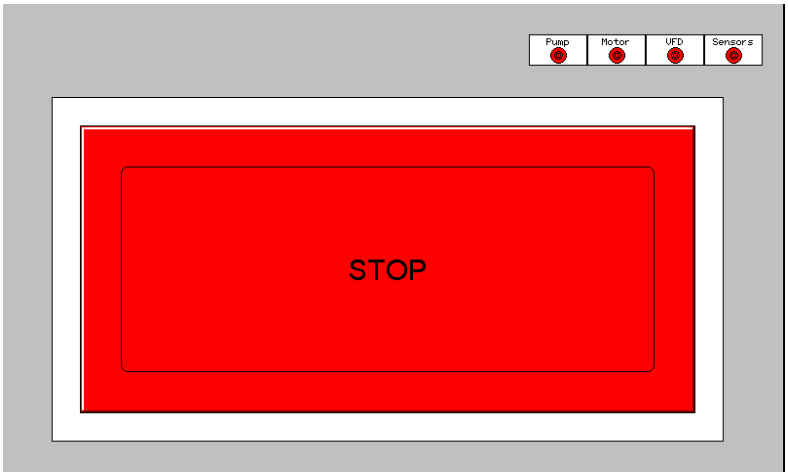


Figure 14: Stop screen

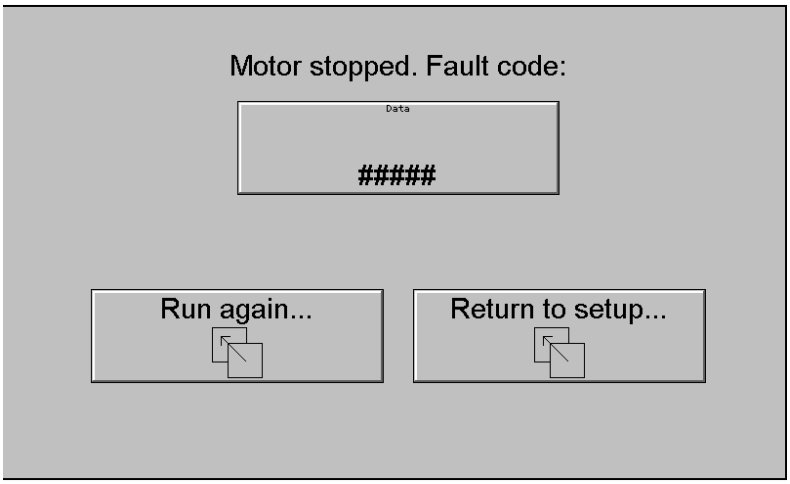


Figure 15: Fault code display screen

Monitoring sensor values

1. You may monitor sensor values by selecting the "Sensor Info…" button on the start screen (Figure 19). This will allow you to observe the current sensor readings. Note that there is no motor control available in this mode.
2. Scroll through the different sensor display screens (Figures 17-20) using the "Previous" and "Next" buttons, or return to the initial setup by pressing the "Setup…" button.

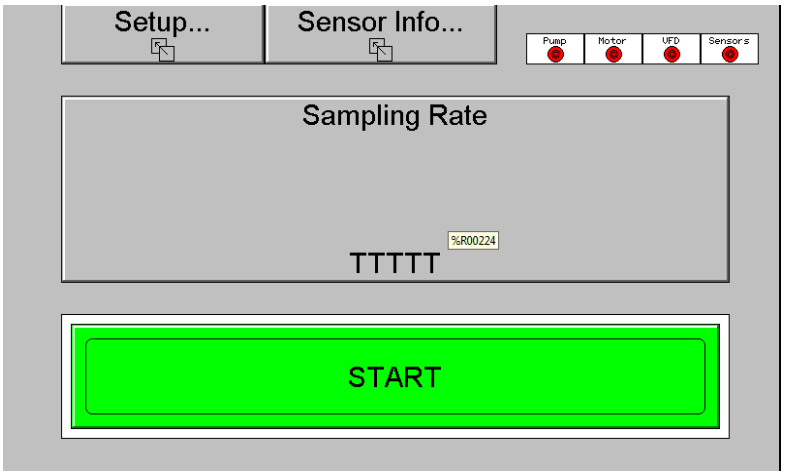


Figure 16:Start screen

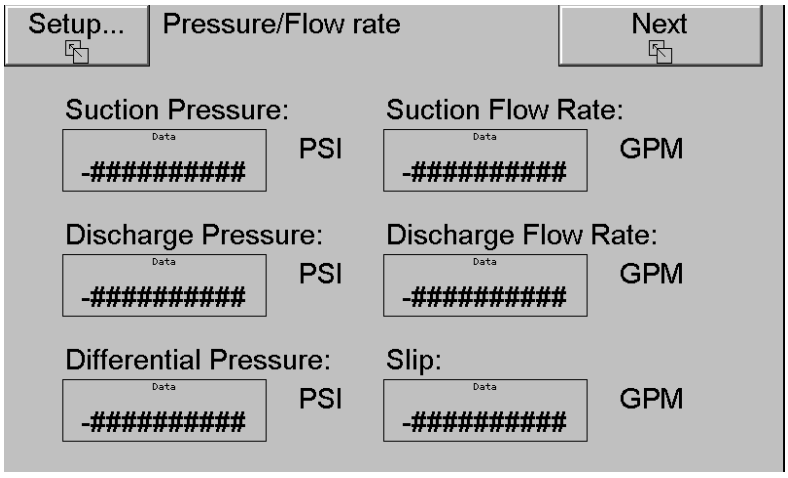


Figure 17: Pressure and flow rate monitoring screen

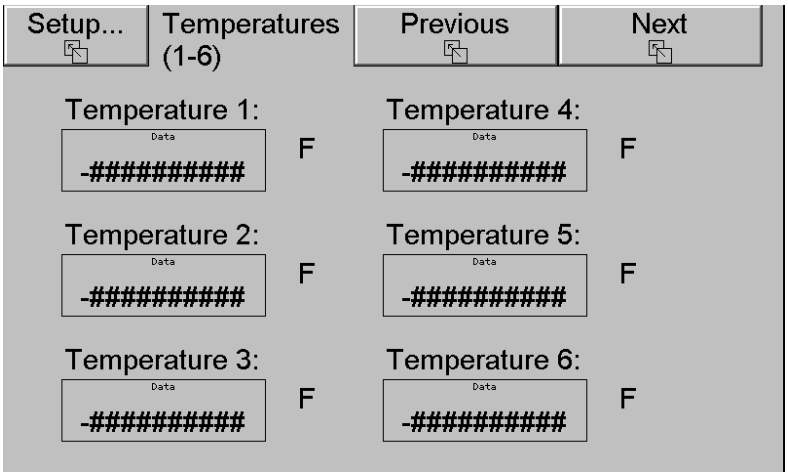


Figure 18: Temperatures 1-6 monitoring screen

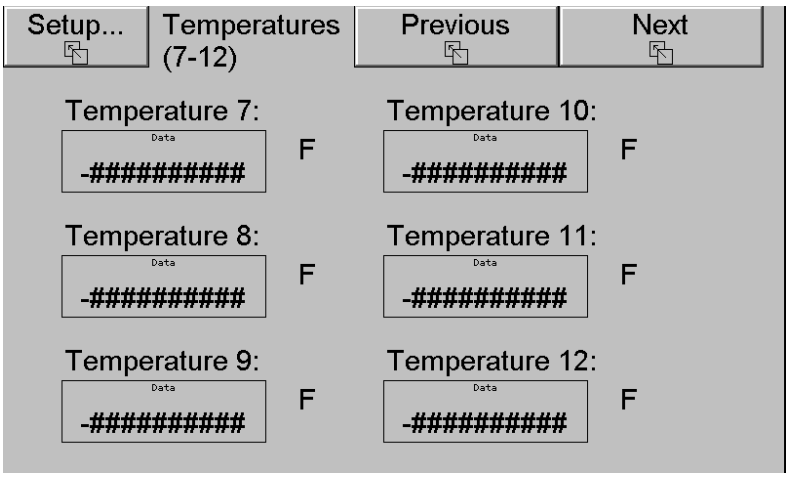
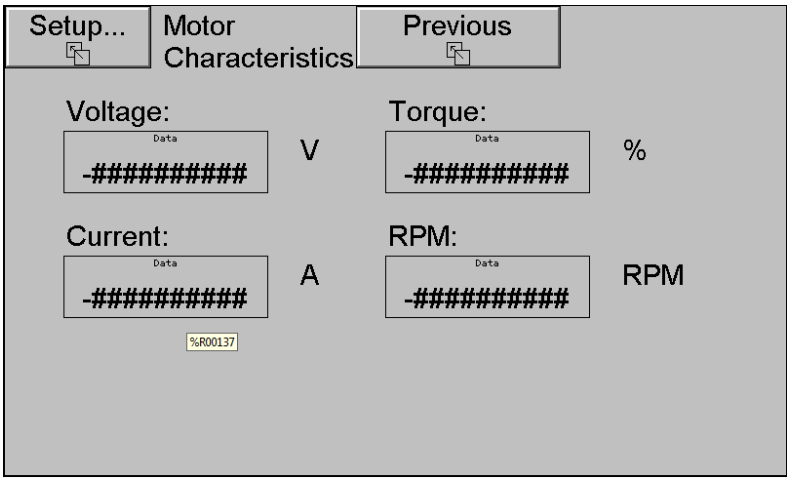


Figure 19: Temperatures 7-12 monitoring screen



Appendix: Table of fault codes

Code	Detailed description
0	No errors occurred
1	User pressed 'Stop' to end data acquisition
2	User pressed Emergency stop
3	Communication timeout with VFD
4	Out of bounds (suction pressure (pressure #1))
5	Out of bounds (discharge pressure (pressure #2))
6	Out of bounds (differential pressure)
7	Out of bounds (suction flow (flowmeter #1))
8	Out of bounds (discharge flow (flowmeter #2))
9	Out of bounds (temperature (TC #1))
10	Out of bounds (temperature (TC #2))
11	Out of bounds (temperature (TC #3))
12	Out of bounds (temperature (TC #4))
13	Out of bounds (temperature (TC #5))
14	Out of bounds (temperature (TC #6))
15	Out of bounds (temperature (TC #7))
16	Out of bounds (temperature (TC #8))
17	Out of bounds (temperature (TC #9))
18	Out of bounds (temperature (TC #10))
19	Out of bounds (temperature (TC #11))
20	Out of bounds (temperature (TC #12))
21	Out of bounds (voltage)
22	Out of bounds (current)
23	Out of bounds (torque)
24	Out of bounds (RPM)
25	Out of bounds (water level)